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In re Application of
Toshihiro SHIMA

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For: PRINT SYSTEM, PRINTING METHOD, AND PRINTER

Honorable Commissioner of Patents
Alexandria, VA 22313-1450

DECLARATION UNDER 37 CFR 1.55(a)
(Pursuant to 37 CFR 1.68)

Sir:

I, Reiji SAMESHIMA, declare and state:

that I am a citizen of Japan, having an Office at P.O. Box 521, ARK Mori Building 13F, 12-32, Akasaka 1-chome, Minato-ku, Tokyo, 107-6013 JAPAN;

that I well understand the Japanese and English languages;

that the attached English-language document is full, true and faithful translation made by me of Japanese Application No. 09-239395 filed on September 4, 1997 on which the right of priority under the International Convention is claimed for the above-identified application.

I declare further that all statements made herein of my own knowledge are true that all statements made on information and belief are believed

to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful statements may jeopardize the validity of the Application or any patent issuing thereon.

Date: April 21, 2004

R. Sameshima

Reiji SAMESHIMA

PATENT OFFICE

Japanese Government

This is to certify that the annexed is a true copy of the following application as filed with this Office.

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[Title of the Invention] LOCAL ROUTER, LOCAL ROUTER RELAYING METHOD, AND NETWORK PRINTER

[Inventor]

[Address or Residence] c/o Seiko Epson Corporation, 3-5, Owa 3-chome, Suwa-shi, Nagano

[Name] Toshihiro SHIMA

[Applicant for Patent]

[Identification No.] 000002369

[Name or Appellation] SEIKO EPSON CORPORATION

[Representative] Hideaki YASUKAWA

[Agent]

[Identification No.] 100095371

[Attorney]

[Name or Appellation] Teruyuki KAMIMURA

[Agent]

[Identification No.] 100089277

[Attorney]

[Name or Appellation] Osao MIYAGAWA

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[DOCUMENT NAME] SPECIFICATION

[TITLE OF THE INVENTION] LOCAL ROUTER, LOCAL ROUTER RELAYING METHOD, AND NETWORK PRINTER

[CLAIMS]

[Claim 1] A local router comprising:

network communications means which can connect to a communications network and has a plurality of network addresses representing a plurality of locations on the network and which responds to a communications message addressed to any of the plurality of network addresses; and

data transfer means which can transfer the data included in a communications message addressed to any of the plurality of network addresses to a plurality of destinations and selects destinations of the data according to the network address of the communication message.

[Claim 2] The local router as defined in Claim 1, wherein the local router can connect itself to one or more network-incompatible devices, and the selected network-incompatible devices are included in the destinations.

[Claim 3] The local router as defined in Claim 2, wherein the devices are printers.

[Claim 4] The local router as defined in any one

of Claims 1 through 3, wherein the network uses a TCP/IP protocol, and the network communications means has a plurality of IP addresses, a plurality of port numbers, or a plurality of identifiers as the plurality of network addresses and responds to a packet which is received from the network and includes any of the plurality of IP addresses, the port numbers, and the identifiers, and wherein the data transfer means selects a destination to which data included in the packet are transferred, according to the IP address, port number, or identifier of the packet including any of the plurality of IP addresses, the port numbers and the identifiers.

[Claim 5] A local router relaying method comprising:

a step of responding to a communications message which is received from a communications network and is addressed to any one of a plurality of predetermined network addresses; and

a step of selecting the destination of data included in the communications message in response to the network address included in the communications message addressed to any one of the plurality of network addresses.

[Claim 6] A network printer which can connect to a communications network, comprising:

network communications means which have a plurality of network addresses representing a plurality of locations

on the network and which respond to a communications message received from the network and addressed to any one of the plurality of network addresses;

data transfer means which can transfer to a plurality of destinations the data included in the communications message addressed to any one of the plurality of network addresses and which determines whether to transfer the data to the destination according to the network address of the communications message;

print means which processes and prints the data as at least one destination of the plurality of destinations; and

connection means for connecting the printer to a network-incompatible device as at least one of the plurality of destinations.

[Claim 7] The network printer as defined in Claim 6, wherein the device is another printer.

[Claim 8] A network printer which can connect to a communications network and is communicable with a host provided on the network, comprising:

relaying means which can connect to other devices, has all the network addresses assigned to a device group including the network printer and the devices, and relays communication between the host and the plurality of devices pertaining to the device group, in response to

communication which is sent from the host.

[Claim 9] A network printer which can connect to a communications network and is communicable to a host provided on the network, the printer comprising:

selection means which receives a print request from the host over the network, can process the received print request in various modes, and selects a mode in which the print request is processed according to the contents of the print request.

[Claim 10] A computer-readable program recording medium having recorded thereon a compute program used when a computer executes a local router relaying method, the program comprising:

a step of responding to a communications message which is received from a communications network and is addressed to any one of a plurality of predetermined network addresses; and

a step of selecting the destination of data included in the communications message in response to the network address included in the communications message addressed to any one of the plurality of network addresses.

[Claim 11] A computer-readable program recording medium having recorded thereon a computer program used when a computer implements a network printer which can connect to a communications network, the printer

comprising:

network communications means which have a plurality of network addresses representing a plurality of locations on the network and which respond to a communications message received from the network and addressed to any one of the plurality of network addresses;

data transfer means which can transfer to a plurality of destinations the data included in the communications message addressed to any one of the plurality of network addresses and which determines whether to transfer the data to the destination according to the network address of the communications message;

print means which processes and prints the data as at least one destination of the plurality of destinations; and

connection means for connecting the printer to a network-incompatible device as at least one of the plurality of destinations.

[Claim 12] A computer-readable program recording medium having recorded thereon a computer program used when a computer implements a network printer which can connect to a communications network and is communicable with a host provided on the network, the printer comprising:

relaying means which can connect to other devices,

has all the network addresses assigned to a device group including the network printer and the devices, and relays communication between the host and the plurality of devices pertaining to the device group, in response to communication which is sent from the host.

[Claim 13] A computer-readable program recording medium having recorded thereon a computer program used when a computer implements a network printer which can connect to a communications network and is communicable to a host provided on the network, the printer comprising:

selection means which receives a print request from the host over the network, can process the received print request in various modes, and selects a mode in which the print request is processed according to the contents of the print request.

[DETAILED DESCRIPTION OF THE INVENTION]

[0001]

[Technical Field to which the Invention Belongs]

The present invention generally relates to a local router enabling network-incompatible printer to be connected to a network in a grouped manner and further having relaying function that enables communication between the host and the plurality of devices pertaining to the group, and a printer having functions thereof.

[0002]

[Related Art]

In an existing communications network, e.g., the Internet, one terminal is usually assigned one IP address. Communication between network-compatible terminals, each of which has an IP address and a TCP/IP execution function, form the basis of the network.

[0003]

[Problems that the Invention is to Solve]

For example, in a case where all the printers disposed in an office are to be connected to the Internet, there are many types of existing printers which cannot be directly connected to the Internet, and hence an expensive network adapter must be attached to each of these printers, resulting in a considerably large economic burden. Further, there are many types of existing printers incapable of operating with the network.

[0004]

The foregoing problem may be expressed in terms of a more general problem: that is, a plurality of terminals including both network-incompatible terminals and network-compatible terminals are collected into one group (e.g., all the printers disposed in an office are collected into one group), and no existing means provides a relay function capable of connecting the entire group to a network.

[0005]

With regard to a relay function related to the network, in an existing line there is provided a router which performs a relaying operation called a routing operation (e.g., selection of a communications path, data exchange between adjacent networks, and management of IP addresses of the network) for routing data transferred over the Internet to a desired terminal. However, since the router is intended to relay data between domains within the Internet, the router cannot serve as means for solving the problem, i.e., means for connecting to a network a group including network-incompatible terminals such as those mentioned previously.

[0006]

Accordingly, an object of the present invention is to provide a local router enabling devices which are difficult to solely connect to a network, e.g., one or more network-incompatible printer, to be connected to a network in a grouped manner.

[0007]

Another object of the present invention is to provide a network-compatible printer having function as aforementioned local router.

[0008]

[Means for Solving the Problems]

According to a first aspect of the present invention, there is provided a local router comprising:

network communications means which can connect to a communications network and has a plurality of network addresses representing a plurality of locations on the network and which responds to a communications message addressed to any of the plurality of network addresses; and

data transfer means which can transfer the data included in a communications message addressed to any of the plurality of network addresses to a plurality of destinations and selects destinations of the data according to the network address of the communication message.

[0009]

So long as a network-incompatible device (e.g., a printer) is connected to the local router as a destination of the data, the local router performs communications processing related to the network and serves as a proxy for the network-incompatible device. The data received from the network are transferred to the network-incompatible device. From the viewpoint of the network, the network-incompatible device appears to be a network-compatible device. As mentioned above, the network-incompatible device can connect to the network.

[0010]

According to a second aspect of the present invention, there is provided a network printer which doubles as the local router and has print processing means as at least one of the destinations of the data.

[0011]

According to a third aspect of the present invention, there is provided a network printer which can connect to a communications network and other devices and which has all network addresses assigned to a group of devices including the network printer and other devices connected thereto, the network printer comprising:

means for relaying communication between the host and the plurality of devices pertaining to the device group, in response to communication which is sent from the host provided on the network and which includes any of all the network addresses of the devices pertaining to the device group.

[0012]

With regard to the printers defined in the second and third aspects of the present invention, so long as another network-incompatible device (e.g., a printer) is connected to the network printer, the network printer performs all communications processing operations relative to the network as a proxy for another

network-incompatible device, in relation to the network, and performs communications processing operations for the network printer itself relative to the network. Data are processed by the network printer or transferred to another network-incompatible device according to a communications address of the data. Accordingly, in addition to the network printer, a network-incompatible device which cannot be solely connected to the network is connected to the network as a part of a group. Although the network printer is a single physical printer, it can act as a plurality of network-compatible devices assigned a plurality of network addresses.

[0013]

According to an fourth aspect of the present invention, there is provided a network printer which receives a print request from a host over a communications network and which can process the thus-received print request in many forms, the network printer comprising means for selecting according to the detail of the received print request a mode in which the print request is processed. In the foregoing network printer, according to the details of the print request received from the host (e.g., a network address representing a device to which the print request is addressed or a port address representing an application to which the print request is addressed), a mode in which

the print request is processed can be selected from a plurality of processing modes (e.g., selection of a security level, selection of paper size, selection of either a color print or a monochrome print, or selection of a printer which performs a printing operation according to the print request in a case where other printers are connected to the network printer). Accordingly, from the viewpoint of the host, a single physical printer can act as a plurality of network-compatible printers.

[0014]

The foregoing characteristic functional means of the local router and that of the printer can be typically implemented by means of a computer. A computer program for operating the computer and serving as such functional means can be supplied to the computer via any of various mediums, such as a disk-type storage device, a semiconductor storage device, or a communications line.

[0015]

As a matter of course, the term "network address" used herein implies an address for specifying a node on the network. However, attention should be paid to the fact that the term also implies information which specifies the location of a certain node within the device, a port, a process, and the type of processing. For example, according to TCP/IP protocol, an IP address processed

within the layer of a network is a typical network address. However, a port number processed in the layer of a transport or an identifier processed in the layer of an application, for example, is also one type of network address used herein.

[0016]

[Mode for Carrying Out the Invention]

Hereinafter, preferred embodiments of the present invention will be described with referent to the drawings.

[0017]

Figure 1 is a diagrammatic representation showing a communications network which uses a network printer having a local router function according to an embodiment of the present invention.

[0018]

In Figure 1, a network printer 1 having a local router function connects itself to the Internet 2 and is capable of communicating with a host 5. The network printer 1 is connected to one or more network-incompatible printers 3, 4, ... which cannot connect themselves to the Internet, by way of respective interfaces which are connectable to the printers 3, 4, ... The network printer 1 has its own IP address and also serves as a printer. Accordingly, the network printer 1 can operate as one terminal printer provided on the Internet 2. In addition, the network

printer 1 is also provided with IP addresses of the respective network-incompatible printers 3, 4, ... connected to the printer 1 and has the function of relaying communication between the printers 3, 4, ... and the host 5. Accordingly, the network printer 1 can also operate as a local router for the purpose of connecting the group of network-incompatible printers 3, 4, ... to the Internet 2.

[0019]

Figure 2 is a view for describing the relaying function of the network printer 1 shown in Figure 1 when it serves as a local router.

[0020]

The network printer 1 is connected to, e.g., an Ethernet 7 of an office LAN which is a part of the Internet 2. The network printer 1 has a protocol processing section comprising a physical layer 8 constituting a TCP/IP protocol stack for use in communication performed with the Internet 2, a data link layer 9, a network layer 10, a transport layer 11, and an application layer 12 (e.g., HTTP, FTP, SMTP, or LPR).

[0021]

The network printer 1 has data interfaces such as a serial interface (S) 14, a parallel interface (P) 15, and a universal serial bus (USB) 16. The plurality of

network-incompatible printers 3, 4, 6, ... can be connected to these data interfaces. The network printer 1 also has a protocol processing section comprising three protocol processing sections, that is, a protocol processing section comprising a physical layer 17 constituting a communications protocol stack for USB16 use, a data link layer 18, a network layer 19, a transport layer 20, and an application layer 21; a protocol processing section comprising a physical layer 22 constituting a data communications protocol stack for use with the serial interface 14, a data link layer 23, a network layer 24, a transport layer 25, and an application layer 26; and a protocol processing section comprising a physical layer 27 constituting a data communications protocol stack for use with the parallel interface 15, a data link layer 28, a network layer 29, a transport layer 30, and an application layer 31.

[0022]

In each of the protocol stacks, data are naturally transferred from a lower layer to an upper layer or from an upper layer to a lower layer. In addition, as will be described in detail, data are transferred between the network layer 10 in the TCP/IP protocol stack and the network layers 19, 24, and 29 of the other TCP/IP protocol stacks. As a result, the network-incompatible printers

3, 4, 6, ... can be connected to the Internet 2.

[0023]

Figure 3 shows IP addresses of the network printer 1. As shown in Figure 3, the network printer 1 acquires IP addresses, e.g., "163,141,22,1" to "163,141,22,6" for four printers such as the printer 1 and the other printers 3, 4, and 6. These IP addresses are registered and retained in nonvolatile memory, such as NVRAM, in such a way that the four IP addresses correspond to destinations (e.g., the printer 1, the serial interface 14, the parallel interface 15, and the USB 16) assigned the respective IP addresses. When there is received from the Internet 2 a packet including any of the four IP addresses, the network printer 1 responds to all the received packets. As will be described later, if the IP address of the received packet designates the printer 1, the data contained in the packet are processed by means of the printer 1 itself. In contrast, if the IP address of the received packet designates another destination (S, P, and USB), the packet is transferred to a corresponding destination.

[0024]

Such processing will be performed by means of a configuration shown in Figure 2.

[0025]

A packet issued from the host 5 arrives at the network printer 1 by way of the Ethernet 7. As shown in Figure 4, the packet is initially converted from an electrical signal into a string of data bits by means of the physical layer 8 of the TCP/IP protocol stack. The thus-converted data bit stream is transferred to the data link layer 9. The data link layer 9 interprets a data link header DH provided in the header of the packet and checks a "MAC address" which is included in the data link header DH and represents destination hardware. At the time of manufacture of the network printer 1, the network printer 1 is assigned a unique, specific "MAC address" on the Internet 2, and the data link layer 9 is aware of this MAC address. If the MAC address of destination hardware included in a received packet matches a specific MAC address assigned to the network printer 1, the data link layer 9 deletes the data link head DH from the received packet and transfers the remaining portion of the packet to the network layer 10.

[0026]

The network layer 10 interprets the network header NH provided in the header of the packet received from the data link layer 9 and checks whether or not there is a match between the "IP address" which is included in the network header NH and represents a destination

device and an "IP address" provided in an IP address list stored in the NVRAM such as that shown in Figure 3. As a result, if the IP address of the destination device included in the received packet matches the IP address assigned to the network printer 1, the network layer 10 removes the network header NH from the received packet and transfers the remaining portion of the packet to the transport layer 11. In contrast, if there is a match between the IP address of the destination device included in the received packet and the IP address assigned to the serial interface 14, that assigned to the parallel interface 15, or that assigned to the USB 16, the network layer 10 transfers the received packet to the network layer 19, 24, or 29 of the protocol stack for the serial interface 14, the parallel interface 15, or the USB 16. Figure 4 shows an example in which, since there is a match between the IP address included in the received packet and the IP address of the USB 16, the received packet is transferred to the network layer 19 of the protocol stack for the USB 16. In a case where the network layer 10 of the TCP/IP stack transfers the received packet to the network layer 19, 24, or 29 of another protocol stack, the network layer 10 converts the data format of the packet into a data format which can be handled by the destination network layer 19, 24, or 29. The specific details of the

data format depends on actual specifications of the interfaces 14, 15, and 16. Since the data format is publicly known and is not directly relevant to the essence of the present invention, the data format will not be explained in the present specification. Further, the format or specifications of the data or packet used for the other network-incompatible interfaces 14, 15, and 16 is generally simpler than that used for the TCP/IP protocol.

[0027]

Upon receipt of the packet from the network layer 10, the transport layer 11 of the TCP/IP stack interprets a transport header TH included in the header of the packet and checks a "port number" which is included in the transport header TH and represents a destination application. For example, the TCP/IP protocol system stipulates that a specific port number specify a specific application, e.g., port number 80 designating HTTP, and port number 21 designating FTP. The transport layer 11 is aware of the correspondence between port numbers and applications. Accordingly, if there is a match between the port number of the received packet and the specific port number, the transport layer 11 removes the transport header TH from the received packet and transfers the remaining portion of the packet to an individual protocol

(HTTP, FTP, SMTP, or LPR) of the application layer 12 specified by the port number. The individual protocol of the application layer 12 interprets an application header AH of the received packet and removes the application header AH from the packet, thus preparing net data. The thus-prepared net data are transferred to a processing routine (not shown) contained in the application which corresponds to an "identifier" included in the application header AH. The processing routine interprets the thus-received data (typically a print request, i.e., a print command) and performs a printing operation. In such a case, the network printer 1 performs a printing operation.

[0028]

Upon receipt of the data whose format complies with the network layer 19, 24, or 29 from the network layer 10 of the TCP/IP, the network layer 19, 24, or 29 of the protocol for another interface 16, 14, or 15 transfers the data to the data link layer 18, 23, or 28 of the protocol corresponding to the network. The data link layer 18, 23, or 28 transfers the received data to the physical layer 17, 22, or 27 of the protocol corresponding to the data link layer. The physical layer 17, 22, or 27 converts the data into an electrical signal and transmits the signal to the network-incompatible printer 6, 3, or 4 connected

to the protocol stack corresponding to the physical layer. Accordingly, in such a case, the network-incompatible printer 6, 3, or 4 prints the data. Processing performed in each layer at the time of transfer of data from an upper layer to a lower layer within another protocol stack depends on actual specifications of the interface 14, 15, or 16. Such processing is publicly known and is irrelevant to the essence of the present invention. Therefore, the processing is not described herein. However, the processing performed in the protocol layer in the network-incompatible interface 14, 15, or 16 is generally simpler than that performed by the TCP/IP protocol (e.g., the network header is not distinguished from the data link header DH, or the network header NH and the data link header DH are omitted (i.e., they have a length of zero).

[0029]

In this way, the print request issued from the host 5 and received by the network printer 1 is printed by means of the network printer 1 according to the IP address of the destination included in the print request. Alternatively, the print request is transferred to the network printer 3, 4, or 6, where the print request is subjected to a printing operation.

[0030]

The data (e.g., a notification of printer status or error) output to the host 5 from the network printer 1 or from the network-incompatible printer 3, 4 or 6 are converted into a packet format of the Internet 2 addressed to the host 5 through a processing flow that is the reverse of that mentioned previously. The thus-converted packet format is sent to the Ethernet 7. In this case, when transferring the data to the network layer 10 of the TCP/IP, the network layer 19, 24, or 29 of the network-incompatible interface protocol converts the format of the data into a packet format handled by the network layer 10 (i.e., into the same format as that of the packet transferred to the network layer 10 from the TCP/IP transport layer 11).

[0031]

As mentioned previously, any of the network-incompatible printers 3, 4, and 6 can be connected to the Internet 2. In addition, the invention can be carried out in other embodiments.

[0032]

For example, so long as IP addresses are assigned different priorities within one network printer 1 having a plurality of IP addresses, from the viewpoint of the network one physical network printer can be used as if there existed a plurality of printers having different

functions, by changing a security level or a paper size according to a priority, selection of monochrome or color printing, selection of printing of an image or a text, or selection of ordinary printing or confidential printing which requires a password. Further, even in a case where the network printer itself is assigned one IP address, so long as network-incompatible printers connected to the network printer are identified by port numbers, a plurality of printers can be connected to the network through use of one IP address. Further, a local router having only a relaying function such as that mentioned previously can be used in place of the network printers.

[0033]

In addition to the IP address, another element, e.g., a port number or an identifier, may alternatively be used as the network address. For example, in the configuration shown in Figure 2, when a packet arrives at a network printer 12 from the Ethernet 7, the following protocol processing can be executed.

[0034]

(1) The data link layer 9 acquires only a packet addressed to its physical address (i.e., a MAC address).

[0035]

(2) When finding in a packet received from the data link layer 9 an IP address specifying another printer

3, 4, or 6 (or another interface 14, 15, or 16), the network layer 10 sends the packet to the protocol stack of the specified interface.

[0036]

(3) When finding in a packet received from the network layer 10 a port number specifying another printer 3, 4, or 6 (or another interface 14, 15, or 16), the transport layer 11 sends the packet to the protocol stack of the specified interface.

[0037]

(4) When finding in a packet received from the transport layer 11 an identifier specifying another printer 3, 4, or 6 (or another interface 14, 15, or 16), the application layer 12 sends the packet to the protocol stack of the specified interface.

[0038]

An example of foregoing processing will now be described by reference to a case where an operating system called Windows NT (Microsoft) is used.

[0039]

First, example (2) will be described. In the configuration shown in Figure 1, print command data are transmitted twice to the network printer 1 by issue of two different transmission instructions to the operating system from the host 5.

[0040]

First time: lpr-S 163.141.22.51 print.dat

Second time: lpr-S 163.141.22.52 print.dat

These two transmission instructions are addressed to an identical protocol "LPR" and order the operating system to send print command data called "print.dat" to two different IP addresses "163.141.22.51" and "163.141.22.52". If the former IP address is assigned to the network printer 1 and the latter IP address is assigned to another printer, the data transmitted first are printed by means of the network printer 1, and the data transmitted second are transferred to another printer.

[0041]

Figure 5 shows the foregoing processing. The print command data having a destination IP address of "163.141.22.51" are transmitted to a processing routine within the network printer 1. In contrast, the print command data having a destination IP address of "163.141.22.52" or the print command data having a destination address of "163.141.22.53" are transferred to, e.g., the USB 16 and the network layer 19 and 24 of the serial interface, from the network layer 10 of TCP/IP, and are transferred to the network-incompatible printers 16, 14. In this way, when the destination of print command

data is determined by the network layer 10 of TCP/IP, the network-incompatible printers 16, 14 which are the destinations of the print command data are required to interpret the TCP/IP application layer protocols (LPR, HTTP, or FTP).

[0042]

First, example (3) will be described. Print command data are transmitted twice to the network printer 1 by issue of two different transmission instructions from the host 5.

[0043]

First time: lpr-S 163.141.22.51 print.dat

Second time: ftp163.141.22.51 print.dat

The first transmission instruction is addressed to a protocol "LPR" and signifies transmission of data to an IP address of "163.141.22.51," and the second transmission instruction is addressed to a protocol "FTP" and signifies transmission of data to the identical IP address. The packet transmitted first is given a port number "515" assigned to LPR, and the packet transmitted second is given a port number "21" assigned to FTP. Provided that a port number "515" is assigned to the LPR application of the network printer 1, and that a port number "21" is assigned to another printer, the data transmitted first are printed by means of the network printer 1, but the

data transmitted second are transferred to another printer.

[0044]

Figure 6 shows the foregoing operations. The print command data assigned a destination port number "515" are transmitted to a processing routine within the network printer 1. In contrast, the print command data assigned a destination port number "21" or "81" are transferred to, e.g., the USB 16 and the transport layers 20, 25 of the serial interface, from the transport layer 11 of TCP/IP, and are transferred to the network-incompatible printers 16, 14. Even in this case where the destination of print command data is determined by the transport layer of TCP/IP, the network-incompatible printers 16, 14 to which the print command data are transferred are required to interpret a TCP/IP application layer protocol (LPR, HTTP, or FTP).

[0045]

Next, example (4) will be described. In this case, print command data are transmitted twice to the network printer 1 by issue of two different transmission instructions from the host 5.

[0046]

First time: lpr-S 163.141.22.51 -P PRINTER1 print.dat

Second time: lpr-S163.141.22.51 -P PRINTER2 print.dat

Both the command data transmitted first and the command data transmitted second are addressed to an identical IP address of a protocol "LPR." However, these print command data specify different data queues "PRINTER1" and "PRINTER2" within the application. The LPR protocol enables management of a plurality of print queues inside the protocol and enables holding of print requests in individual print queues. The designation of the print queues "PRINTER1" and "PRINTER2" are incorporated into the packet as identifiers regarding an application layer. At this time, if the identifier "PRINTER1" is assigned to the network printer 1 and the identifier "PRINTER2" is assigned to another printer, the data transmitted first are printed by means of the network printer 1, but the data transmitted second are transferred to another printer.

[0047]

Figure 7 shows the foregoing operations. The print command data having a destination print queue "PRINTER1" are transmitted to a processing routine within the network printer 1. In contrast, the print command data having a destination print queue of "PRINTER2" and a destination print queue of "PRINTER3" are transferred to, e.g., the

USB 16 and a TTY-procedure protocol of application layers 21, 26 of the serial interface, and are transferred to the network printers 16, 14.

[0048]

The foregoing description is based on a specific hierarchical model which is one logical concept. Accordingly, the configuration of a practical system is not necessarily required to correspond in a one-to-one relationship to the above-mentioned hierarchical model. Within the scope of the gist of the present invention, there may be employed variations on the configuration of the print system, such as a print system including a more detailed hierarchical structure or a print system including two or more strata of the foregoing model in the form of one grouped stratum.

[BRIEF DESCRIPTION OF THE DRAWINGS]

[Figure 1]

A diagrammatic representation showing the configuration of a network system which uses a network printer having a local router function according to the present invention.

[Figure 2]

A diagrammatic representation showing the configuration of a relaying function of the network printer shown in Figure 1.

[Figure 3]

A list showing IP addresses stored in the network printer shown in Figure 2.

[Figure 4]

An explanatory view showing a procedure for processing a received packet performed in the network printer shown in Figure 2.

[Figure 5]

An explanatory view showing another procedure for processing a received packet performed in the network printer shown in Figure 2.

[Figure 6]

An explanatory view showing still another procedure for processing a received packet performed in the network printer shown in Figure 2.

[Figure 7]

An explanatory view showing yet another procedure for processing a received packet performed in the network printer shown in Figure 2.

[Description of the Reference Numerals]

1 Network printer

2 Internet

3, 4, 6 Network-incompatible printer

5 Host computer

7 Ethernet

8, 17 Physical layer

9, 18 Data link layer

10 Transport layer

[DOCUMENT NAME] ABSTRACT OF THE DISCLOSURE

[ABSTRACT]

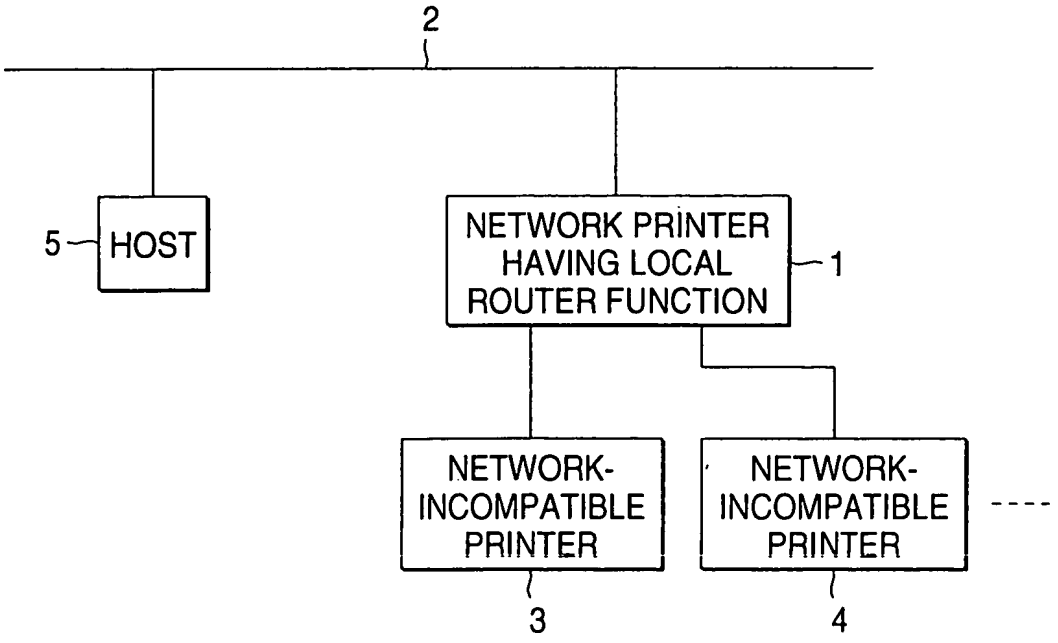
[OBJECT] To provide a network printer having a relay function that enables network-incompatible printer to be connected to a network.

[MEANS FOR RESOLUTION] A network printer 1 connects itself to the network, e.g. Internet 2, and is capable of communicating with a host 5 by executing TCP/IP protocol. The network printer 1 is connected to network-incompatible printers 3, 4. The network printer 1 has its own IP address and IP addresses of the respective network-incompatible printers 3, 4 connected to the printer 1. When there is received from a host 5 a packet including any of the four IP addresses, the network printer 1 responds to all the received packets. The network printer 1 has the function of relaying communication between the printers 3, 4 and the host 5.

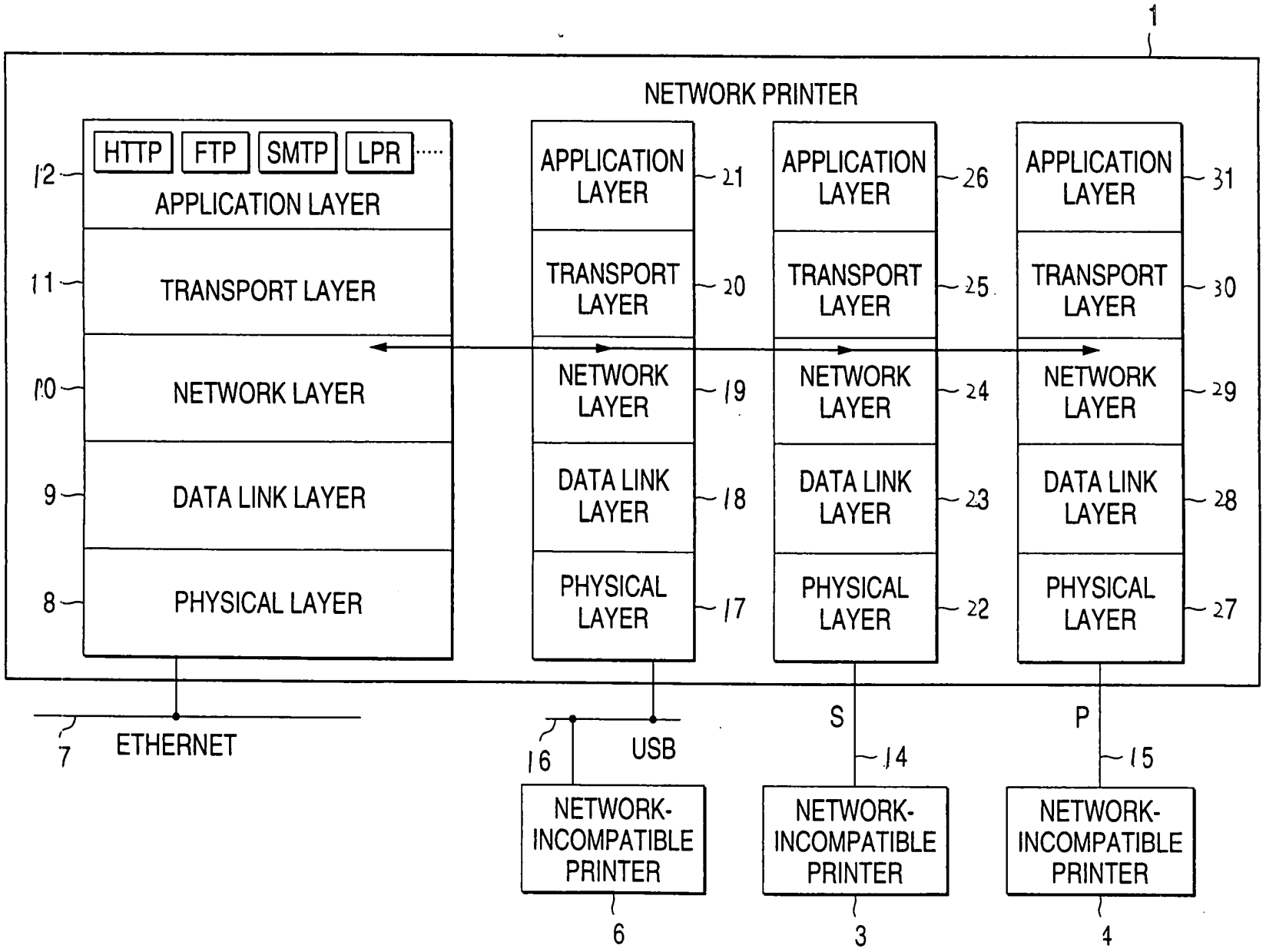
[SELECTED DRAWING] Figure 1

[DOCUMENT NAME] DRAWING

[FIG. 1]



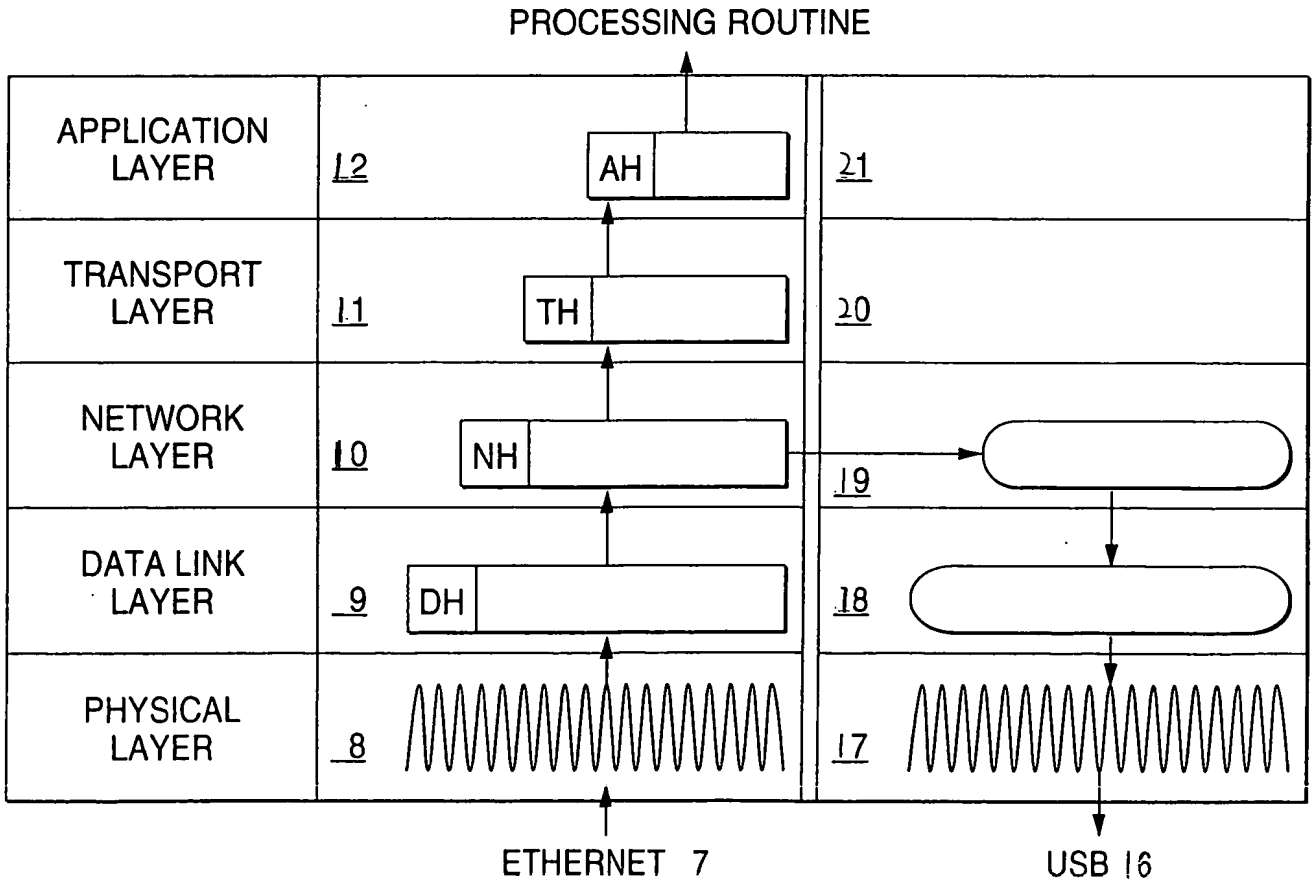
[FIG. 2]


1
NETWORK PRINTER
HTTP
FTP
SMTP
LPR
12
APPLICATION LAYER
11
TRANSPORT LAYER
10
NETWORK LAYER
9
DATA LINK LAYER
8
PHYSICAL LAYER
APPLICATION LAYER
21
TRANSPORT LAYER
20
NETWORK LAYER
19
DATA LINK LAYER
18
PHYSICAL LAYER
17
APPLICATION LAYER
26
TRANSPORT LAYER
25
NETWORK LAYER
24
DATA LINK LAYER
23
PHYSICAL LAYER
22
APPLICATION LAYER
31
TRANSPORT LAYER
30
NETWORK LAYER
29
DATA LINK LAYER
28
PHYSICAL LAYER
27
7
ETHERNET
16
USB
S
14
P
15
NETWORK-INCOMPATIBLE PRINTER
6
NETWORK-INCOMPATIBLE PRINTER
3
NETWORK-INCOMPATIBLE PRINTER
4

[FIG. 3]

IP ADDRESSES	TRANSFER DESTINATION
163, 141, 22, 1	PRINTER ITSELF
" 3	S SERIAL
" 4	P PARALLEL
" 6	USB

[FIG. 4]



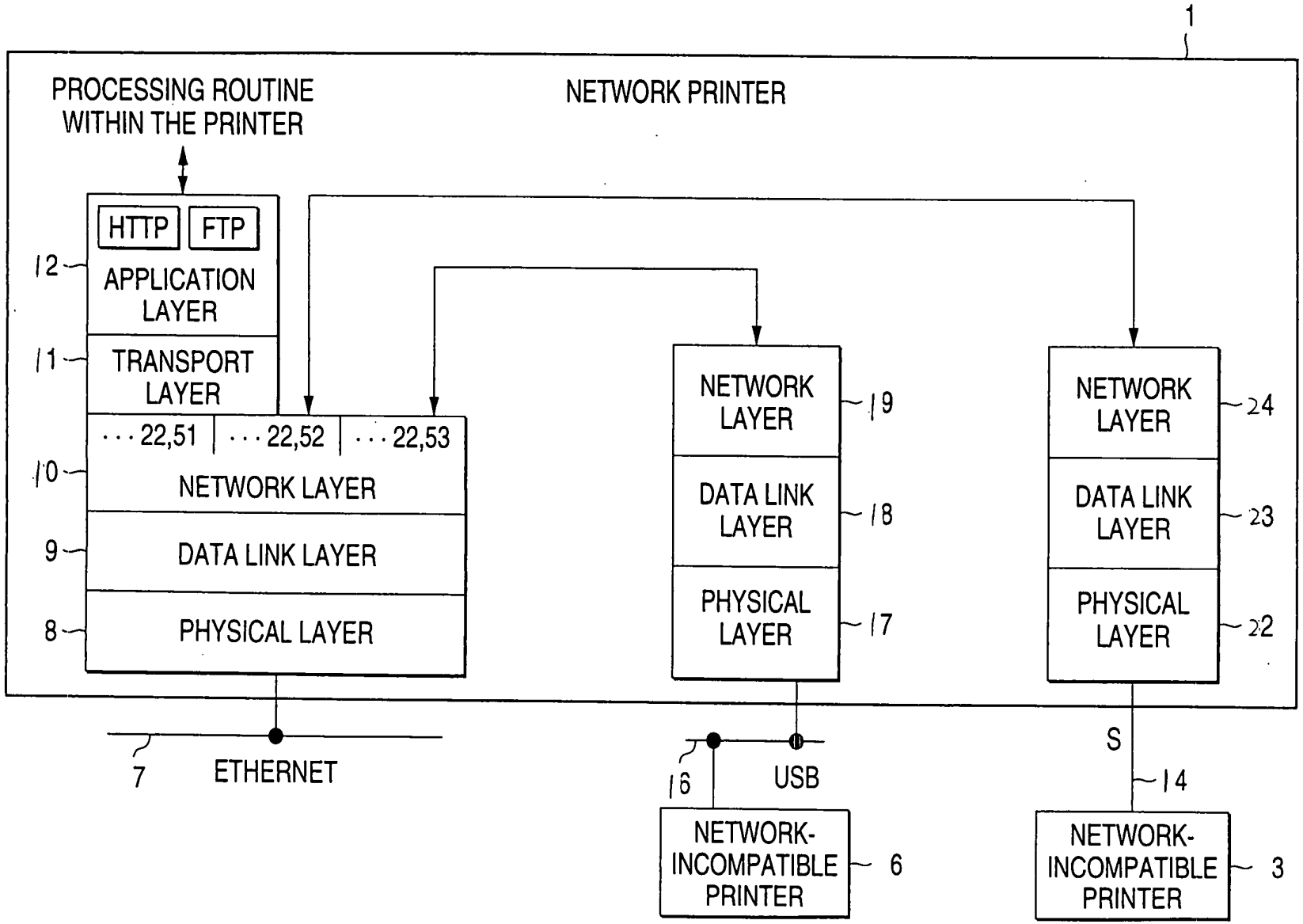

1
PROCESSING ROUTINE WITHIN THE PRINTER
NETWORK PRINTER
HTTP
FTP
12
APPLICATION LAYER
11
TRANSPORT LAYER
· · · 22,51
· · · 22,52
· · · 22,53
10
NETWORK LAYER
9
DATA LINK LAYER
8
PHYSICAL LAYER
NETWORK LAYER
19
DATA LINK LAYER
18
PHYSICAL LAYER
17
NETWORK LAYER
24
DATA LINK LAYER
23
PHYSICAL LAYER
22
7
ETHERNET
16
USB
S
14
NETWORK-INCOMPATIBLE PRINTER
6
NETWORK-INCOMPATIBLE PRINTER
3

FIG. 5]

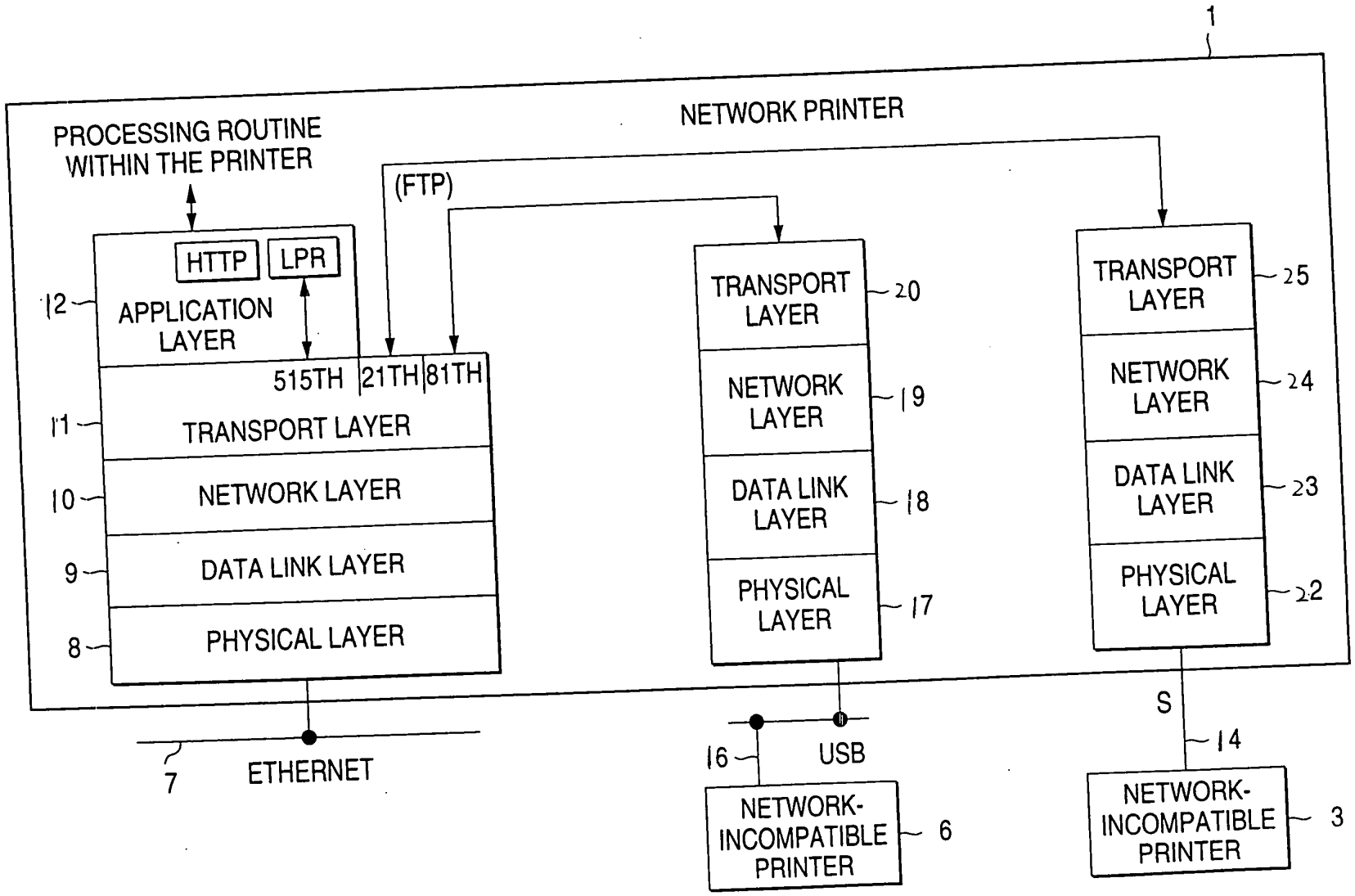
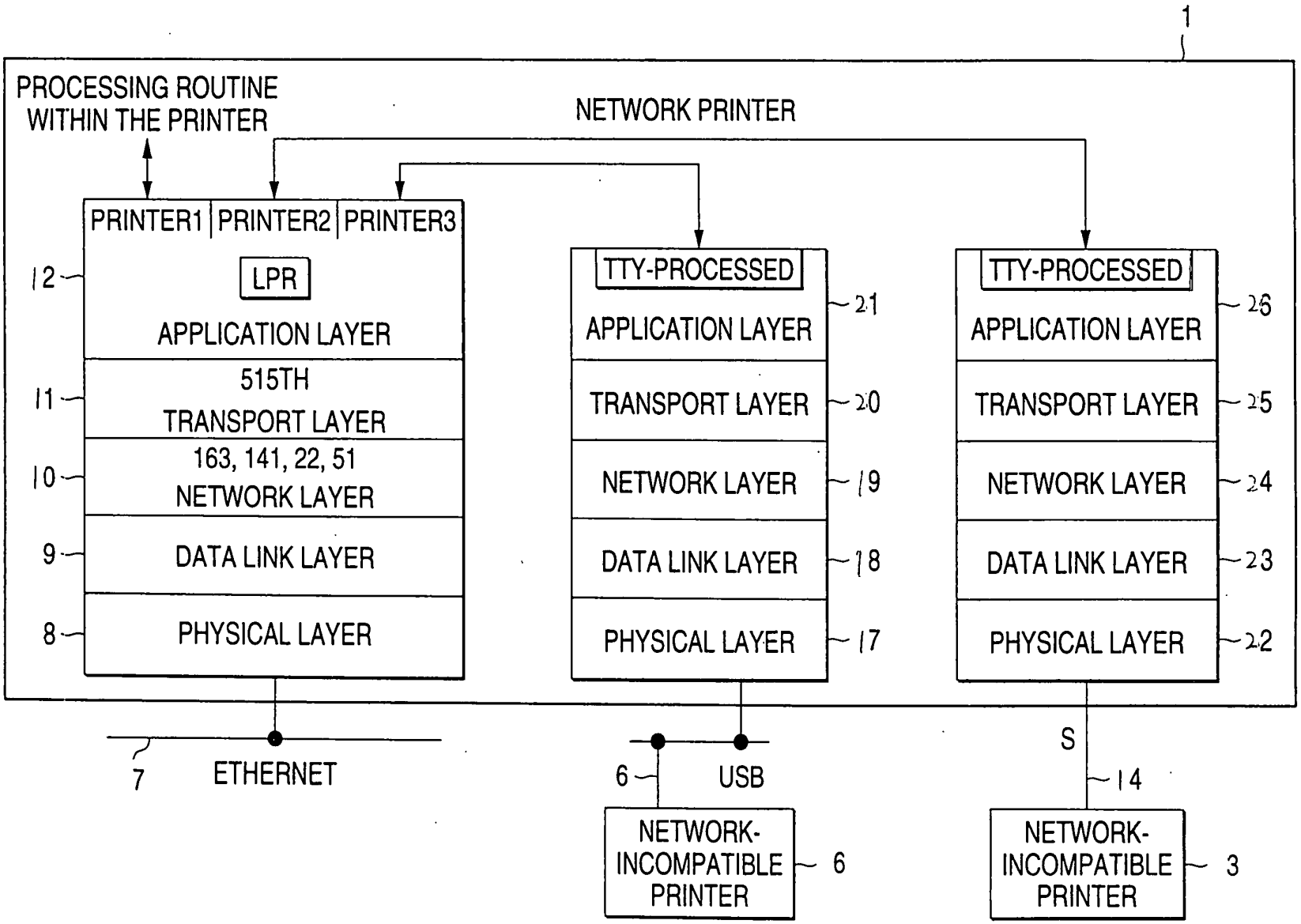

1
NETWORK PRINTER
PROCESSING ROUTINE WITHIN THE PRINTER
(FTP)
HTTP
LPR
12
APPLICATION LAYER
515TH
21TH
81TH
11
TRANSPORT LAYER
10
NETWORK LAYER
9
DATA LINK LAYER
8
PHYSICAL LAYER
7
ETHERNET
TRANSPORT LAYER
20
NETWORK LAYER
19
DATA LINK LAYER
18
PHYSICAL LAYER
17
16
USB
NETWORK-INCOMPATIBLE PRINTER
6
TRANSPORT LAYER
25
NETWORK LAYER
24
DATA LINK LAYER
23
PHYSICAL LAYER
22
S
14
NETWORK-INCOMPATIBLE PRINTER
3

FIG. 6

FIG. 1


1
PROCESSING ROUTINE WITHIN THE PRINTER
NETWORK PRINTER
PRINTER1
PRINTER2
PRINTER3
12
LPR
APPLICATION LAYER
11
515TH
TRANSPORT LAYER
10
163, 141, 22, 51
NETWORK LAYER
9
DATA LINK LAYER
8
PHYSICAL LAYER
TTY-PROCESSED
APPLICATION LAYER
21
TRANSPORT LAYER
20
NETWORK LAYER
19
DATA LINK LAYER
18
PHYSICAL LAYER
17
TTY-PROCESSED
APPLICATION LAYER
26
TRANSPORT LAYER
25
NETWORK LAYER
24
DATA LINK LAYER
23
PHYSICAL LAYER
22
7
ETHERNET
6
USB
S
14
NETWORK-INCOMPATIBLE PRINTER
6
NETWORK-INCOMPATIBLE PRINTER
3